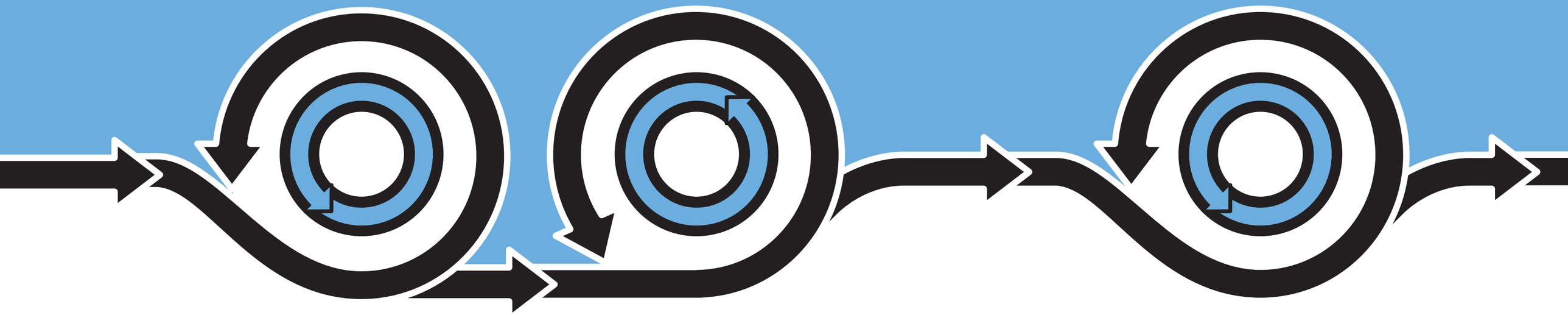
Modern Roundabout Feasibility Study

Ohio Drive at Gaylord Parkway, Warren Parkway and Prestmont Place
City of Frisco



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1.0 INTRODUCTION

1.1 Background

This report documents a preliminary capacity analysis and feasibility study for three proposed modern roundabouts on Ohio Drive in the City of Frisco. The modern roundabouts are proposed for the intersections of Ohio Drive at Gaylord Parkway, Ohio Drive at Warren Parkway, and Ohio Drive at Prestmont Place. The study area is generally located north of State Highway 121 (SH 121) and east of State Highway 289 (Preston Road). See **Figure 1** for a study area location map. The study includes the following elements:

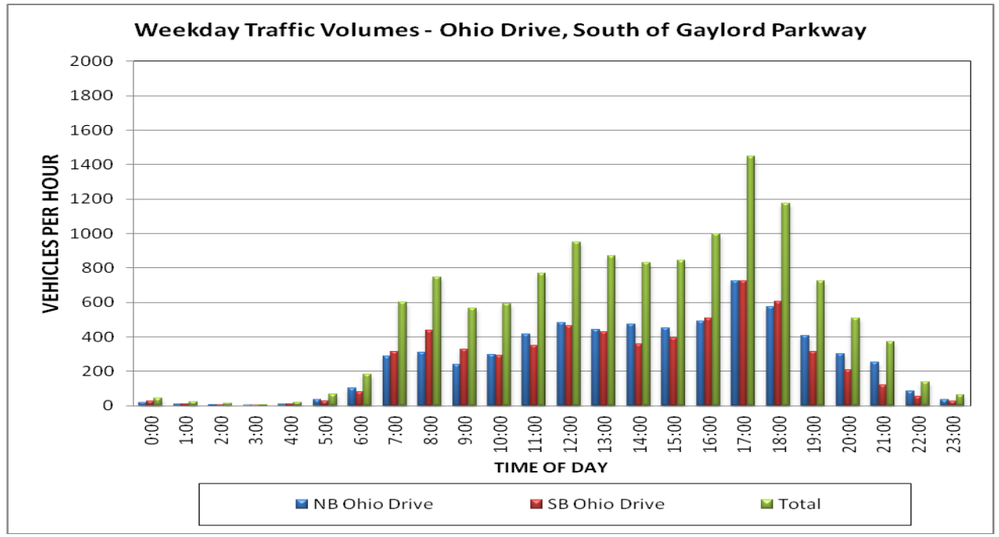
- Analysis of existing traffic volumes, development of traffic projections for the year 2030, and analysis of capacity and level of service for both existing and projected conditions
- Development of conceptual roundabout designs to determine constructability, drainage impacts, utility impacts, and right-of-way requirements
- Preparation of preliminary cost estimates

A modern roundabout was considered based on its safety and delay reduction benefits. According to the Federal Highway Administration (FHWA) roundabout guide, experiences in the United States show a reduction in crashes after building a roundabout of 35% for all crashes and 76% for injury crashes and 90% to 100% of fatal crashes. These percent reductions were based on an evaluation of 9 signalized intersections and 46 un-signalized intersections converted to roundabouts. Collisions at roundabouts tend to be less severe than at conventional intersections due to the elimination of left-turn, head-on, and right-angle collisions. The number of vehicle-vehicle conflict points decreases from 32 for a typical four-legged intersection to 8 for a roundabout. A Dutch study of 181 intersections converted to roundabouts found reductions in all vehicle-pedestrian accidents of 73 percent. Pedestrians only have to look one way at a time, and vehicle speeds are low on the approach to a roundabout. In addition, vehicle delay is significantly reduced due to the roundabout's yield operation.

1.2 Existing Conditions

The surrounding land use is comprised of commercial retail and single-family land uses. The area west of Ohio Drive is generally occupied with commercial uses while the area east of Ohio Drive consists of some undeveloped land and residential neighborhoods. There is a fire station located at the northwest corner of the intersection of Ohio Drive and Warren Parkway.

Ohio Drive is currently a six-lane boulevard between SH 121 and Warren Parkway. Ohio Drive transitions to a 4-lane boulevard north of Warren Parkway. The posted speed limit on Ohio Drive is 45 miles per hour (mph) south of Warren Parkway and 40 mph to the north of Warren Parkway. Pedestrian sidewalks are discontinuous along Ohio Drive. Ohio Drive is currently designated as part of an on-street bike route. At this time, each of the study intersections is un-signalized and controlled with all-way STOP signs. **Figure 2** provides photographs of each of the intersections.



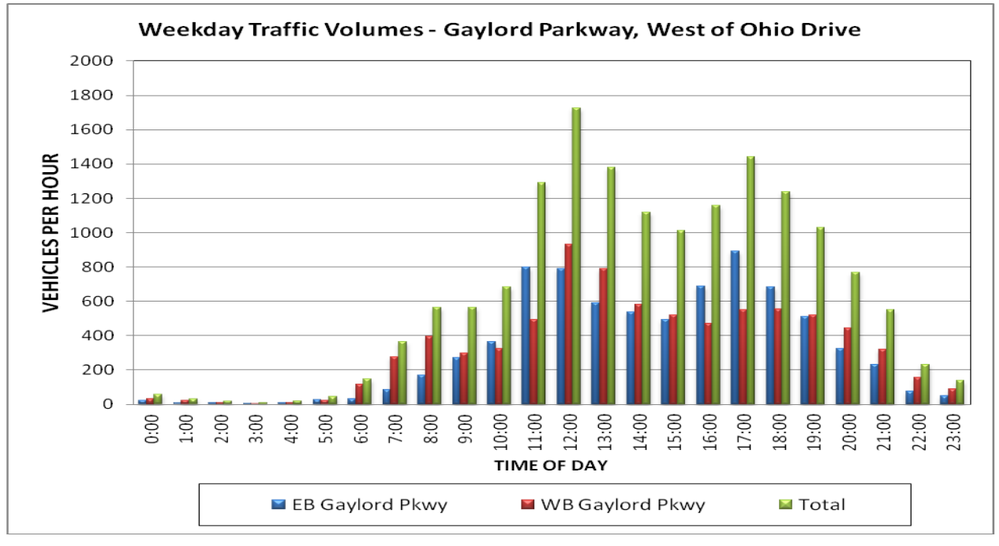


Figure 3 - Summaries of 24-hour Bi-directional Traffic Counts

2.0 TRAFFIC VOLUMES

Existing traffic counts were conducted during the second week of February 2012. The data collection included typical weekday AM, Noon, and PM peak hour turning movement counts at each of the study intersections. Turning movement counts were also conducted on a Saturday afternoon peak period. In addition, 24-hour directional counts were collected on Ohio Drive between SH 121 and Lebanon Road.

2.1 24-Hour Counts

Currently, Ohio Drive carries approximately 12,600 vehicles per day (vpd) between SH 121 and Gaylord Parkway and approximately 11,200 vpd between Gaylord Parkway and Warren Parkway. Heavier peaking conditions are generally during the afternoon commuting peak hours, in which northbound and southbound traffic volumes are relative equal.

Figure 3 provides a graphical summary of 24-hour volumes on Ohio Drive and Gaylord Parkway. **Table 1** provides a summary of the recent traffic counts.

Table 1 - Summary of Existing Daily Volumes

Roadway	Existing Daily Volume (vpd)
Ohio Drive South of Gaylord Parkway	12,560
Ohio Drive South of Warren Parkway	11,247
Ohio Drive South of Prestmont Place	10,365
Gaylord Parkway West of Ohio Drive	10,456
Gaylord Parkway East of Ohio Drive	540 [1]
Warren Parkway West of Ohio Drive	9,056
Warren Parkway East of Ohio Drive	4,748
Prestmont Place West of Ohio Drive	1,490 [1]
Prestmont Place East of Ohio Drive	1,860 [1]

Notes: [1] Volume was estimated from available peak hour counts and K-factors.

2.2 Peak Hour Turning Movement Counts

Based on the results of the peak hour turning movement counts, the overall weekday peak hour periods for the morning and afternoon are 7:30 to 8:30 AM and 5:00 to 6:00 PM, respectively. The weekend peak hour occurred on a Saturday, between 1:15 and 2:15 PM. **Figures 4, 5 and 6** show the existing peak hour turning movement volumes for a weekday and a Saturday.

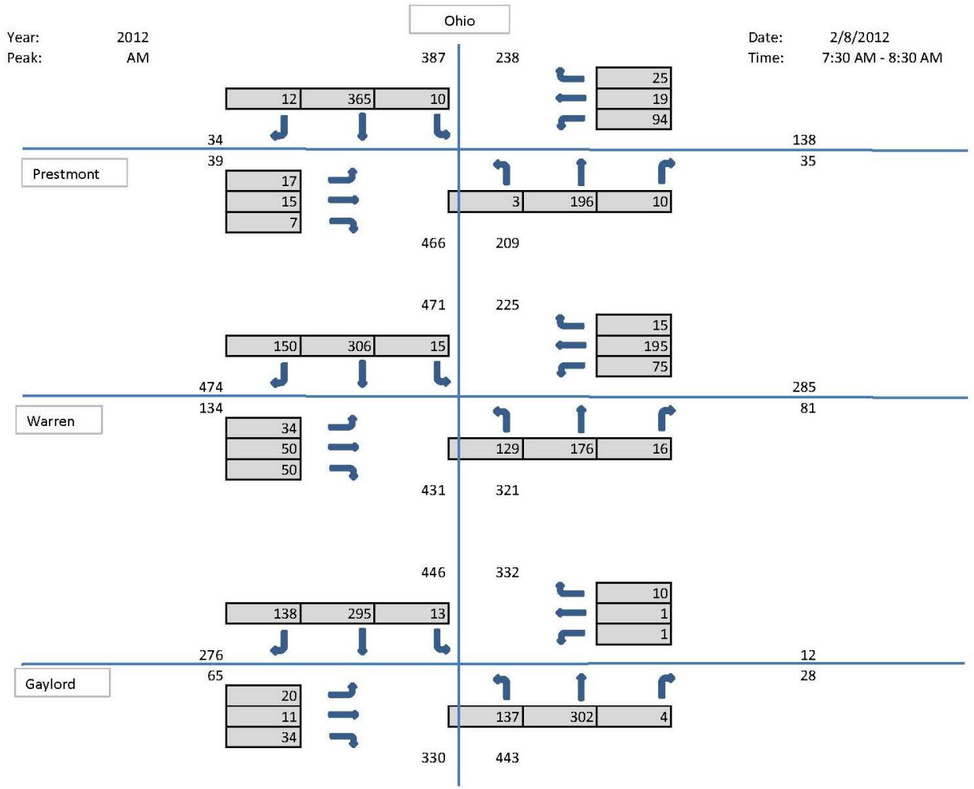


Figure 4 – Existing Weekday AM Peak Turning Movement Volumes

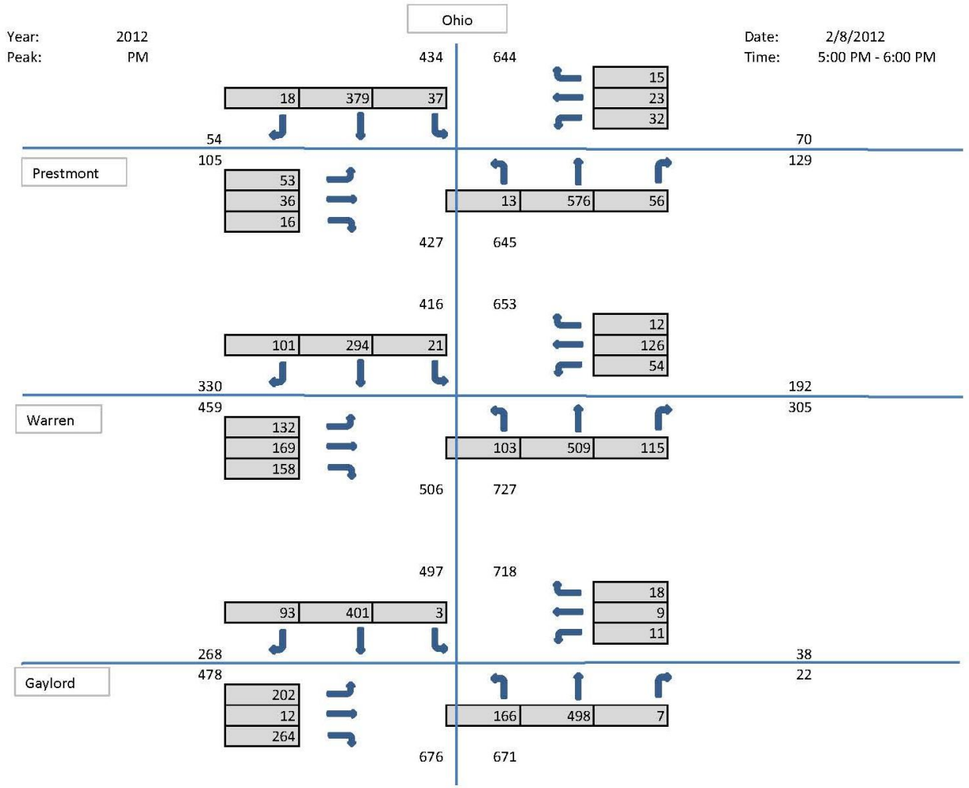


Figure 5 – Existing Weekday PM Peak Turning Movement Volumes

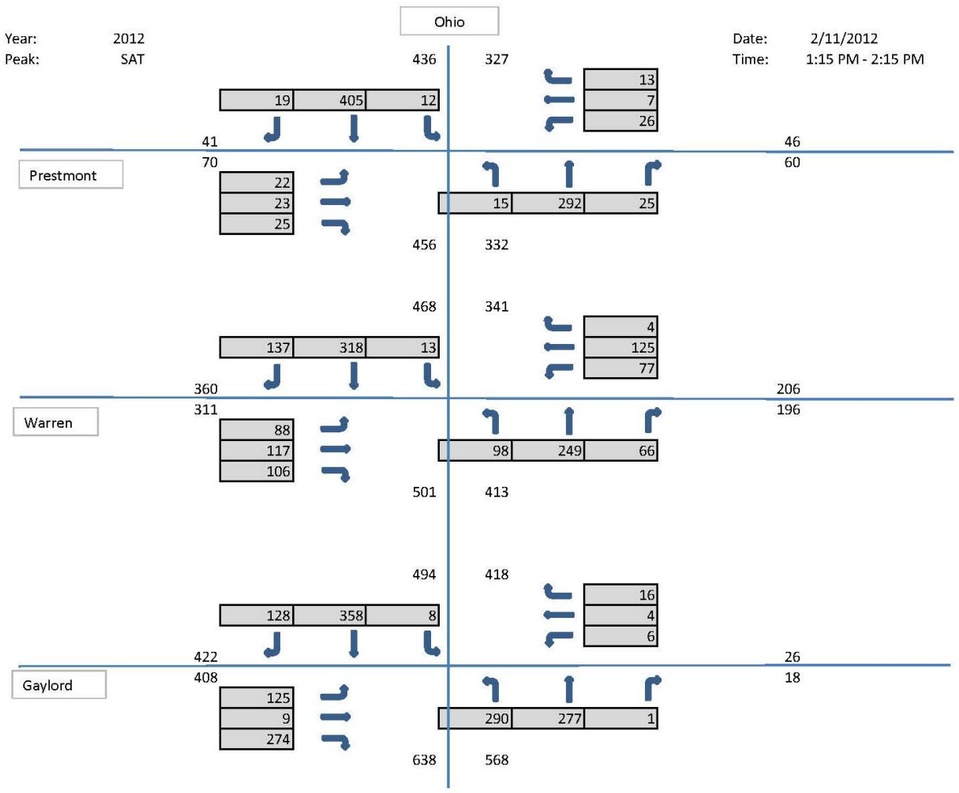


Figure 6 – Existing Saturday PM Peak Turning Movement Volumes

2.3 Historical Traffic Data

Historical traffic data was provided by the City of Frisco's traffic count database as well as the North Central Texas Council of Government's (NCTCOG) traffic count information system. Historical daily traffic volumes on each of the roadways providing principle circulation within the study area were gathered as part of this study. Available daily traffic volumes on Ohio Drive are plotted in **Figure 7**. As shown in this figure, volumes were higher in early 2000's and dropped between 2006 and 2008. The current trend between 2008 and 2012 is an upward growth of traffic volumes on Ohio Drive. The dotted line illustrates the general trend of the scatter plot.

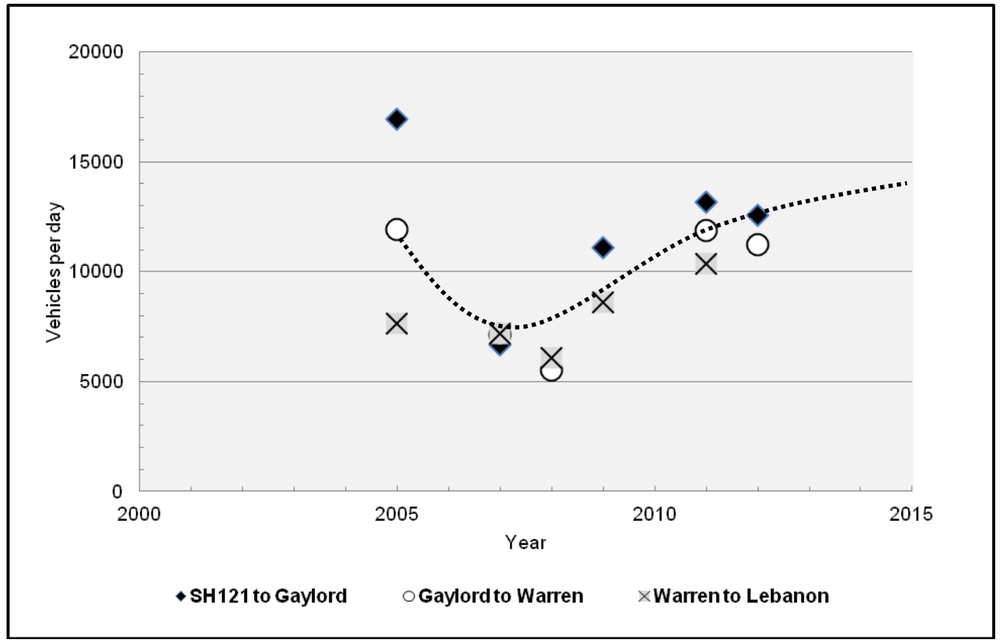


Figure 7 – Plot of Historical Daily Volumes for Ohio Drive

2.4 Traffic Projections

Traffic volume projections for each of these study intersections were developed for years 2015 and 2030. For the purposes of this study, existing traffic volumes were considered as year 2015 base volumes. Traffic projections were determined based on an analysis of historical growth patterns and current trends. Also, the current TransCAD travel demand model assignments were reviewed. Other considerations included roadway capacity, network connectivity, and the availability of undeveloped land along the corridor. The roadway connectivity of Ohio Drive is limited since it veers to the east and terminates at Coit Road. Ohio Drive functions as a minor thoroughfare. The current traffic volumes on Ohio Drive (12,600 vpd) are relatively low when

compared to nearby thoroughfares such as Preston Road that carry 56,000 vpd. This is an indication that Ohio drives functions more as a local roadway than a major thoroughfare.

Figure 8 below illustrates a comparison of the projected growth trend based on the City of Frisco's TransCAD travel demand model (dashed line) and the projected growth trend based on projected growth rates (solid line). The TransCAD model traffic assignments indicate that Ohio Drive will experience volumes ranging between 29,000 vpd and 33,000 vpd by the year 2030. However, roadway facilities that experience over 30,000 vpd are typically longer and function as thoroughfares in the roadway network. These traffic assignments were considered too high for Ohio Drive.

The solid line in the plot represents the projected growth trend based on assumed growth rates that vary depending on the growth potential on the various roadway segments. Since there is still some undeveloped land along the corridor, a 5% compounded annual rate was used for the first 10 years, and a 2% annual growth rate after that until year 2030.

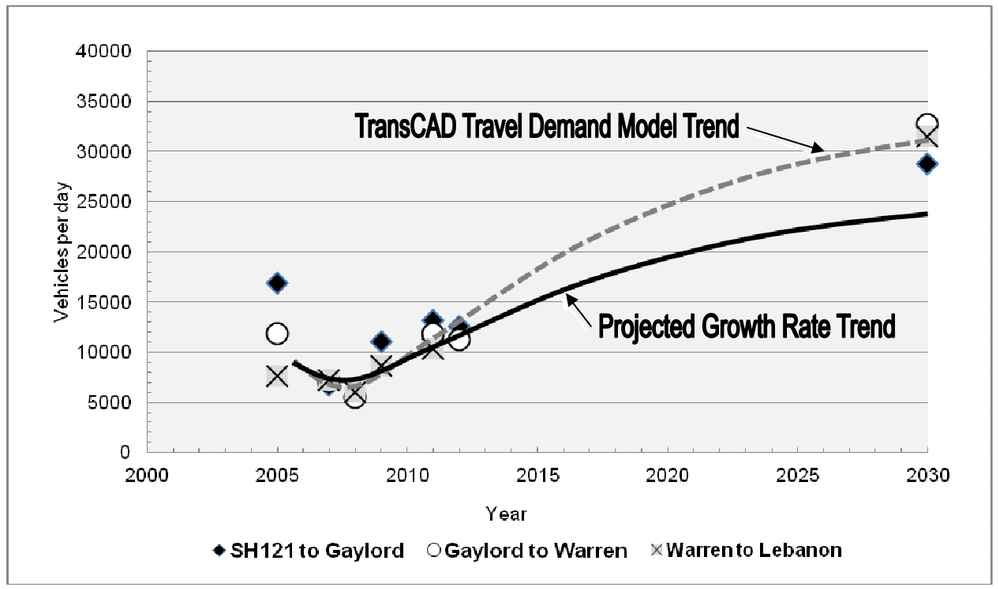


Figure 8 - Projected Growth Trend for Ohio Drive

Where there is significant growth anticipated, a 5% compounded annual rate was used for the first 10 years, and a 2% annual growth rate after that until year 2030. Other roads where less growth is anticipated, a 2% annual growth rate was utilized. **Table 2** provides a summary of the traffic projections for Ohio Drive, Gaylord Parkway, Warren Parkway and Prestmont Place.

Table 2 - Summary of Ohio Drive Traffic Projections

Roadway	Existing Daily Volume (vpd)	Projected 2030 Daily Volume (vpd) Based on Growth Rates
Ohio Drive South of Gaylord Parkway	12,560	23,860
Ohio Drive South of Warren Parkway	11,247	21,370
Ohio Drive South of Prestmont Place	10,365	19,690
Gaylord Parkway West of Ohio Drive	10,456	16,500
Gaylord Parkway East of Ohio Drive	540	11,900
Warren Parkway West of Ohio Drive	9,056	16,500
Warren Parkway East of Ohio Drive	4,748	11,900
Prestmont Place West of Ohio Drive	1,490	2,130
Prestmont Place East of Ohio Drive	1,860	1,860

The growth rates that were used would roughly double the traffic on Ohio Drive over the next 18 years. This would result in Ohio Drive carrying approximately 24,000 vpd. Based on these traffic volumes projections, it was determined that double-lane roundabouts would be suitable for the Ohio Drive intersections at Gaylord Parkway and Warren Parkway. A partial double-lane roundabout was determined to be adequate for the intersection of Ohio Drive and Prestmont Place. The Prestmont Place approaches to Ohio Drive would consist of single-lane approaches to the partial double-lane roundabout. These determinations were based on a planning-level approach outlined in the National Cooperative Highway Research Program (NCHRP) Report 672: Roundabouts, An Informational Guide, 2nd Edition. The planning-level capacity of a two-lane roundabout is in the 40,000 to 45,000 vpd range. The intersection of Ohio Drive at Gaylord Parkway is projected to experience approximately 37,000 vpd. The intersection of Ohio Drive at Warren Parkway is projected to experience approximately 35,000 vpd.

3.0 CAPACITY AND LEVEL OF SERVICE ANALYSIS

3.1 LOS Concepts

The operations of the study intersections can be measured in terms of their levels of service (LOS), a value that represents the operating conditions that may occur on a roadway or at an intersection when accommodating various levels of traffic volumes. It is a qualitative measure responsive to the effects of a number of operational factors such as intersection geometry, traffic signal control parameters, traffic volume fluctuations, pedestrian activity, and others. In applying these LOS measurements to an intersection, it is possible to compare the operational qualities of the intersection under different conditions and alternatives.

LOS values range from A, which is characterized by traffic flows under unencumbered free-flow conditions with little or no delay, to F, which is characterized by traffic flows under stop-and-go conditions, like peak hour or extreme congestion. The intermediate levels of service reflect the spectrum of conditions that exist between levels A and F. LOS B represents a condition with short delays to traffic. LOS C (average traffic delay) is considered desirable for peak or design traffic flow. In urban areas LOS D (more significant delays than LOS C) is generally considered acceptable during peak hour conditions. LOS E indicates that capacity has been reached.

The LOS values are a function of vehicle delay as defined in Transportation Research Board's *Highway Capacity Manual* (*HCM*). The ranges of delay and corresponding LOS for both signalized and unsignalized conditions are outlined in **Table 3**. According to the *HCM*, the LOS criteria for signalized and unsignalized conditions are different primarily because user perceptions differ among each facility type. The expectation is that a signalized intersection is designed to carry higher traffic volumes and will present greater delay than an unsignalized intersection. In addition, unsignalized intersections are associated with more uncertainty and unpredictable delay for users, which can reduce the user's tolerance.

Table 3 - LOS and Control Delay Criteria

LOS	*Two-way and All-way Stop Control (seconds per vehicle)*	*Signalized Intersection (seconds per vehicle)*
A	≤10	≤10
B	>10 and ≤15	>10 and ≤20
C	>15 and ≤25	>20 and ≤35
D	>25 and ≤35	>35 and ≤55
E	>35 and ≤50	>55 and ≤80
F	>50	>80

Intersection capacity provides another measure of efficiency. Capacity is measured in terms of the ratio of actual vehicular volume to its available capacity and is an indication of the level of congestion experienced by each lane group. When the volume-to-capacity (V/C) ratio equals or exceeds 1.0 the lane group is operating at or above capacity. For the purpose of this study, maximum V/C ratios are reported for the most congested lane group on each approach.

3.2 Highway Capacity Manual V/C Analysis for Roundabouts

Chapter 21 of the 2010 *Highway Capacity Manual* provided the guidance in estimating the future V/C ratios for each of the roundabout geometric alternatives. The HCM methodology is based on regression models developed by studying roundabouts in the U.S. The field data collected during these studies was used to derive statistical relationships between basic geometric features, volumes, and capacity. However, from a network standpoint, this methodology does not consider the effects from adjacent signals or nearby disturbances in the traffic stream. In addition, the details regarding the size and geometry of the roundabout are not taken into account, nor factors such as gap acceptance to enter the roundabout.

The V/C ratios and levels of service (LOS) were estimated for year 2015 (existing) traffic volumes and projected year 2030 traffic volumes. Chapter 21 of the 2010 HCM provided the detailed methodology for the analyses of the proposed roundabouts. The procedures outlined in the HCM uses a combination of regression and analytical models for both single and double-lane roundabout operations. The required input data includes the lane configuration of each approach to the roundabout, the demand volume for vehicles and pedestrians, and heavy vehicle percentages.

3.2.1 Analysis Results

Under each analysis year (2015 and 2030), the weekday PM peak hour was analyzed since this period was found to be the highest volume peak period for the study intersections. Based on the existing turning movement count data, the AM peak hour volumes ranged between 57% and 68% of the PM peak hour volumes. In addition, the Saturday PM peak volumes ranged between 71% and 89% of the PM peak hour volumes. Therefore, the Saturday peak hour was also analyzed as the second highest peak period. **Table 4** provides a summary of the 2015 capacity analysis results.

Table 4 - Summary of 2015 LOS Analysis

Intersection	Approach	Year 2015 Weekday PM Peak			Year 2015 Saturday Peak		
		LOS	Delay (sec/veh)	V/C	LOS	Delay (sec/veh)	V/C
Ohio at Gaylord Double-lane Roundabout	NB	A	8.8	0.41	A	8.0	0.38
	SB	A	7.0	0.30	A	7.9	0.33
	EB	A	8.4	0.33	A	7.7	0.30
	WB	A	6.9	0.04	A	5.8	0.02
	ALL	A	8.1	0.35	A	7.9	0.34
Ohio at Warren Double-lane Roundabout	NB	B	10.3	0.47	A	6.3	0.24
	SB	A	7.0	0.27	A	7.6	0.31
	EB	A	7.8	0.31	A	6.7	0.21
	WB	A	8.1	0.18	A	6.2	0.16
	ALL	A	8.6	0.35	A	6.8	0.24
Ohio at Prestmont Partial Double-lane Roundabout	NB	A	7.5	0.35	A	4.9	0.17
	SB	A	5.6	0.22	A	5.4	0.22
	EB	A	5.9	0.14	A	5.4	0.09
	WB	A	6.4	0.11	A	4.6	0.05
	ALL	A	6.7	0.28	A	5.2	0.18

The year 2030 analysis, summarized in **Table 5,** includes right-turn bypass lanes for the proposed roundabouts at Gaylord Parkway and at Warren Parkway. The Gaylord Parkway roundabout will probably need the right turn by-pass lanes on all approaches, while the Warren Parkway roundabout may need them on the northbound, southbound and eastbound approaches.

Table 5 - Summary of 2030 LOS Analysis

Intersection	Approach	Year 2030 Weekday PM Peak			Year 2030 Saturday Peak		
		LOS	Delay (sec/veh)	V/C	LOS	Delay (sec/veh)	V/C
Ohio at Gaylord Double-lane Roundabout	NB	E	35.5	0.77	E	41.2	0.73
	SB	B	13.2	0.49	C	21.7	0.62
	EB	D	26.0	0.71	C	17.0	0.55
	WB	C	24.7	0.61	C	15.3	0.43
	ALL	D	26.2	0.66	D	26.7	0.61
Ohio at Warren Double-lane Roundabout	NB	E	39.5	0.82	A	9.6	0.39
	SB	B	10.7	0.40	B	11.8	0.45
	EB	B	14.2	0.52	B	10.6	0.35
	WB	D	31.4	0.69	B	14.1	0.46
	ALL	D	26.0	0.63	B	11.4	0.41
Ohio at Prestmont Partial Double-lane Roundabout	NB	C	16.0	0.70	A	6.7	0.32
	SB	A	7.9	0.40	A	8.1	0.43
	EB	A	8.5	0.23	A	7.8	0.14
	WB	B	10.8	0.16	A	6.0	0.08
	ALL	B	12.6	0.55	A	7.5	0.36

Under the 2015 weekday PM conditions, each of the proposed roundabouts on Ohio Drive are projected to operate at excellent LOS. Under the projected 2030 conditions, the capacity analysis indicates that the double-lane roundabouts at the intersections of Ohio Drive at Gaylord Parkway and Ohio Drive at Warren Parkway are projected to operate at acceptable LOS, with all V/C ratios under 1.0. Although the northbound Ohio Drive approaches at Gaylord Parkway and at Warren Parkway are projected to operate at LOS E during the 2030 peak hours, each intersection as a whole would operate at acceptable LOS D or better. The partial double-lane roundabout at Ohio Drive and Prestmont Place is anticipated to adequately handle the projected traffic volumes under year 2030 PM peak conditions, with a projected intersection LOS B. The complete analysis worksheets are provided in **Appendix A**.

3.2.2 Analysis Conclusions

Traffic volume projections for each of these study intersections were developed for years 2015 and 2030. Traffic projections were determined based on an analysis of historical growth patterns and current trends as well as roadway capacity, network connectivity, and the availability of undeveloped land. The partial double-lane roundabout at Ohio Drive and Prestmont Place is projected to operate at LOS B under year 2030 PM peak conditions. The results of the capacity analysis indicates that the double-lane roundabouts at the intersections of Ohio Drive at Gaylord Parkway and Ohio Drive at Warren Parkway are projected operate at LOS D or better under the projected 2030 conditions.

4.0 CONCEPTUAL ROUNDABOUT DESIGN

4.1 Roundabout Design Criteria

The conceptual roundabout layout designs were developed primarily by the following guidelines:

- *Roundabouts: An Informational Guide 2nd Edition (2010)* – FHWA NCHRP #672
- *Roadway Design Manual (May 2010)* - TxDOT
- *A Policy on Geometric Design of Highways and Streets (2004)* – AASHTO

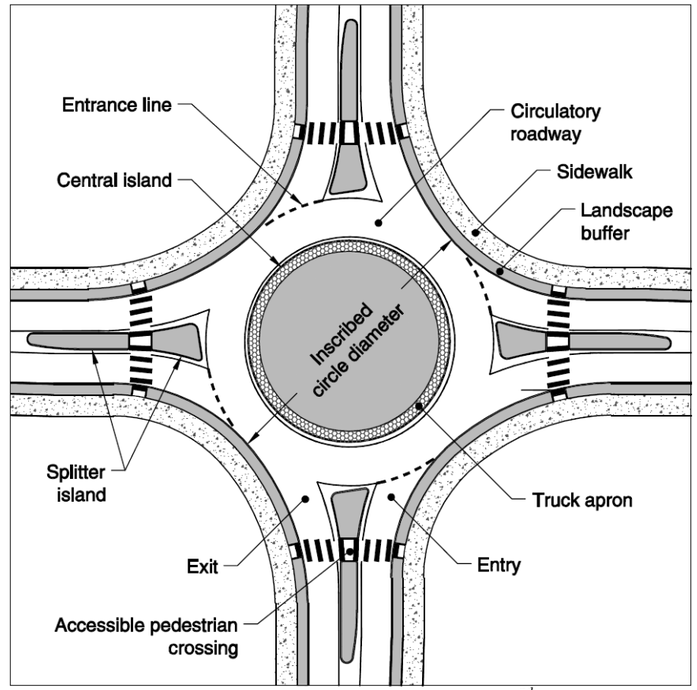
Table 6 is a summary of the design criteria used for the proposed roundabout concepts. Under the two-lane roundabout concepts for Gaylord Parkway and Warren Parkway, each movement will include two lanes through the roundabout as well as on the entries and exits of the roundabout. However, the eastbound departures will only provide a single lane exit. Under the partial two-lane roundabout concept for Prestmont Place, the minor east-west movements will provide a single lane approach to the roundabout. The approaches to the roundabout were designed with a left-offset, which improves the vehicle deflection at the roundabout entries.

Table 6 - Summary of Roundabout Design Criteria

Criteria	
Design Vehicle	WB-50 Truck
Inscribed Diameter	150 feet
Entry Design Speed	30 mph (35 mph max)
Circulatory Roadway Width	28 feet (Two Lanes)
Truck Apron Width	10 feet

While the design vehicle was a WB-50 truck, the roundabout design was also checked for the City's largest fire engine, to ensure that the fire engine would be able to navigate around the roundabout even with a car blocking one of the lanes. In addition, to make the design fire engine friendly, the truck apron will likely be a textured concrete surface of a different color but flush with the circulatory roadway pavement, such that the fire engine will be able to navigate over the truck apron without a bump. Section 4.5 shows illustrations of the WB-50 truck and fire engine turning wheel paths for the critical turns around the roundabouts.

Figure 9 provides a review of the basic geometric features and key dimensions of a roundabout.



Source: FHWA *Roundabouts: An Informational Guide 2nd Edition*

Figure 9 - Basic Geometric Elements of a Roundabout

The design of a roundabout allows pedestrians to cross one direction of traffic at a time on each leg of the roundabout. Pedestrians can expect an approaching vehicle from one direction, rather than multiple directions such as a left-turn, right-turn, or through movement. The crosswalks are set back approximately 20 feet from the yield line, which is enough space for one vehicle to store prior to entering the roundabout. This encourages the driver behind the entering vehicle to focus on crossing pedestrians. These safety benefits are also applicable to bicyclists. Depending on their skill level, cyclists may enter the roundabout with a decision process that mirrors the operation of motorized vehicles. The lower speed environment within the roundabout would provide more time for all users to detect and correct for their mistakes or the mistakes of others.

4.2 Ohio Drive at Gaylord Parkway

The existing skewed intersection angles and large intersection area lend itself to fit a two-lane roundabout within the existing intersection footprint, existing pavement, and within the existing right-of-way. Therefore, the roundabout can be built utilizing mostly existing pavement. The pavement drainage pattern is such that the existing drainage system can be utilized with relatively minor modifications: inlet relocations and pipe connections into existing sewer lines; a concept level drainage analysis is included in Section 5.1 of this report. The existing right-turn lanes on the northwest and southeast corners can be modified to become right turn bypass lanes for the roundabout, which will increase the capacity of the roundabout. The Ohio Drive approaches to the roundabout can be reduced from three lanes to two lanes. The third lane can be utilized and designated as a bicycle lane, since Ohio Drive is a designated bicycle route in the City. Small amounts of right-of-way corner clips will be needed on the southwest and northeast corners in order to provide an adequate border for pedestrian sidewalks and joint use bike ways. The large electrical vault located on the southwest corner of the intersection can be avoided. Impacts to utilities will be minimal, if any. The center island can be landscaped with low-height plantings that enhance the beauty of the area. The splitter islands will transition into the existing landscaped median islands and as such can be landscaped with similar greenery. Other areas behind the joint use walkways and bike paths can also be landscaped once the concrete pavements are removed. The overall green space will increase significantly. The truck apron and nose portion of the splitter islands can be finished with decorative brick patterns to enhance the aesthetics of the project. **Figure 10** illustrates the proposed roundabout geometry for this intersection.

The proposed roundabout geometry at Gaylord Parkway does not impact any existing access driveways or median openings. According to the City of Frisco's engineering standards, future driveways along Ohio Drive or Gaylord Parkway will require a minimum spacing of seventy-five feet (75') in advance of the right-of-way line of the intersecting street or two-hundred feet (200') downstream from the right-of-way line of the intersecting street. These requirements will not be impacted by the proposed roundabout.

4.3 Ohio Drive at Warren Parkway

The existing intersection size lends itself to fit a two-lane roundabout mostly within the existing intersection area, existing pavement, and within the existing right-of-way. Therefore, the roundabout can be built utilizing mostly existing pavement. The pavement drainage pattern is such that the existing drainage system can be utilized with relatively minor modifications: inlet relocations and pipe connections into existing sewer lines. A small amount of right-of-way corner clips will be needed on the northeast corner mostly to provide an adequate border for pedestrian sidewalks and joint use bike ways. **Figure 11** illustrates the proposed roundabout geometry for this intersection. Features similar to the roundabout at Gaylord Parkway can be built into this roundabout

The proposed roundabout geometry at Warren Parkway does not impact any existing access driveways or median openings. Future driveways along Ohio Drive or Warren Parkway will require a minimum setback of seventy-five feet (75') in advance of the right-of-way line of the intersecting street or two-hundred feet (200') downstream from the right-of-way line of the intersecting street, per city's requirements.

4.4 Ohio Drive at Prestmont Place

Unlike the previous two intersections, this intersection's existing footprint is smaller and will not fit a two-lane roundabout within the existing pavement. In addition, the proposed roundabout would be shifted to the west in order to avoid the amenities built at the entrance to the subdivision. The intersection will have to be rebuilt. Still, the existing drainage system can be utilized with relatively minor modifications: inlet relocations and pipe connections into existing sewer lines. The Impacts to utilities will be minimal and will primarily consist of relocations/adjustments of a fire hydrant, water valves and sewer manholes. The existing sign for the childcare business will not be affected. **Figure 12** illustrates the proposed roundabout geometry for this intersection.

The proposed roundabout geometry at Prestmont Place does not impact any existing access driveways or median openings. Future driveways along Ohio Drive will require a minimum spacing of seventy-five feet (75') in advance of the right-of-way line of the intersecting street or two-hundred feet (200') downstream from the right-of-way line of the intersecting street, per City's requirements. Future driveways along the west leg of Prestmont Place will require a minimum spacing of one-hundred feet (100') in advance of or downstream from the right-of-way line of the intersecting street.

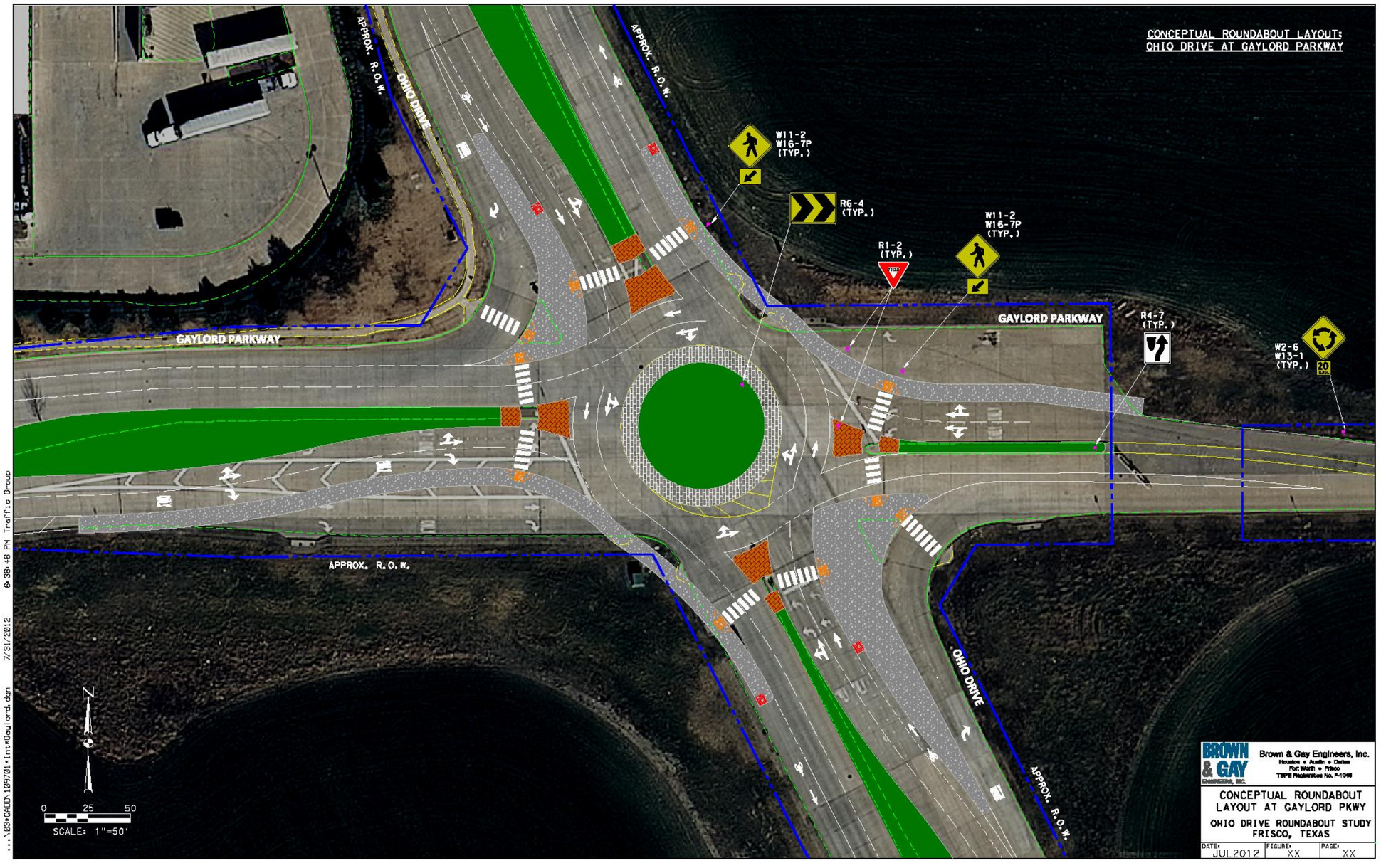


Figure 10 – Proposed Roundabout: Ohio Drive at Gaylord Parkway

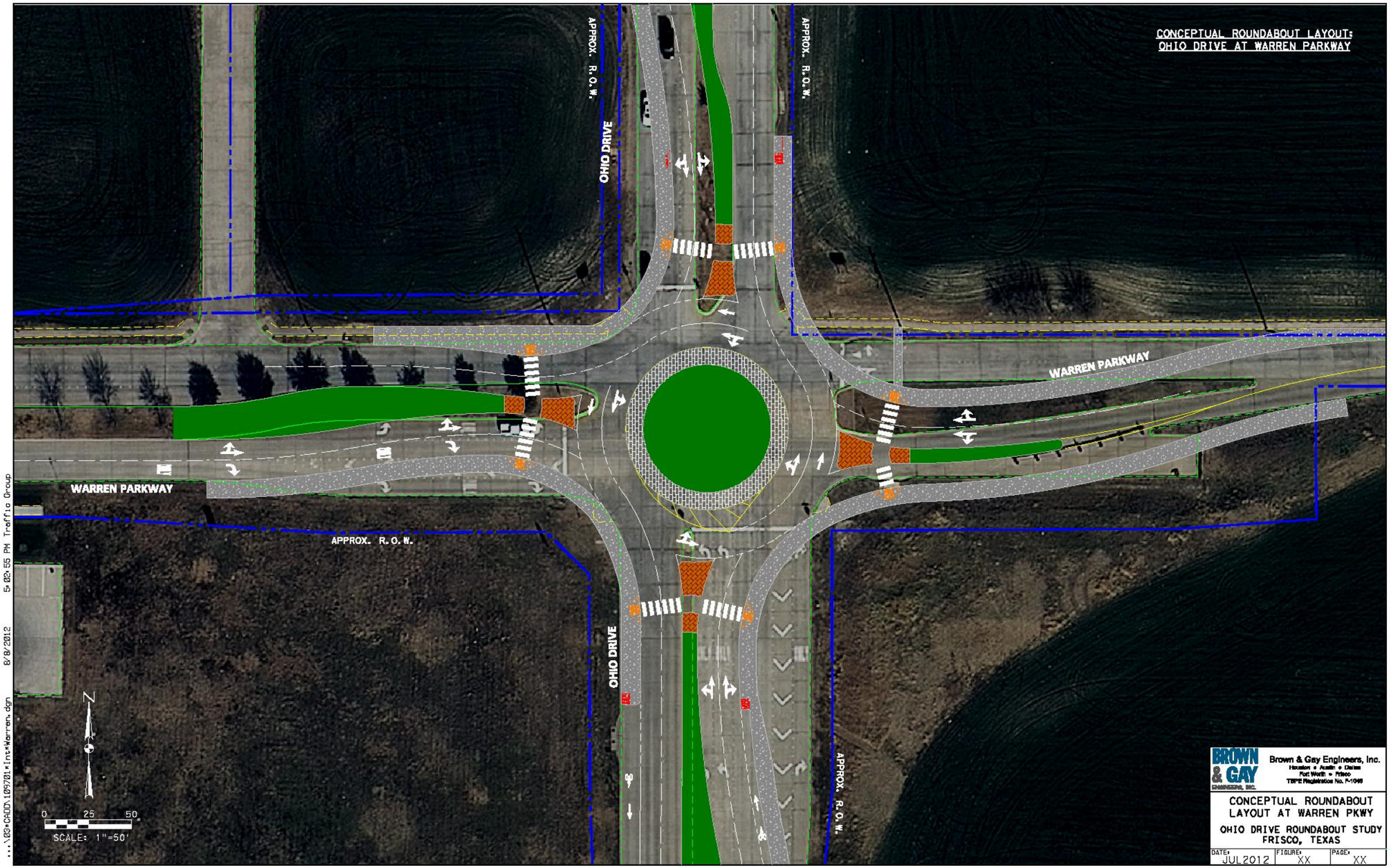


Figure 11 – Proposed Roundabout: Ohio Drive at Warren Parkway

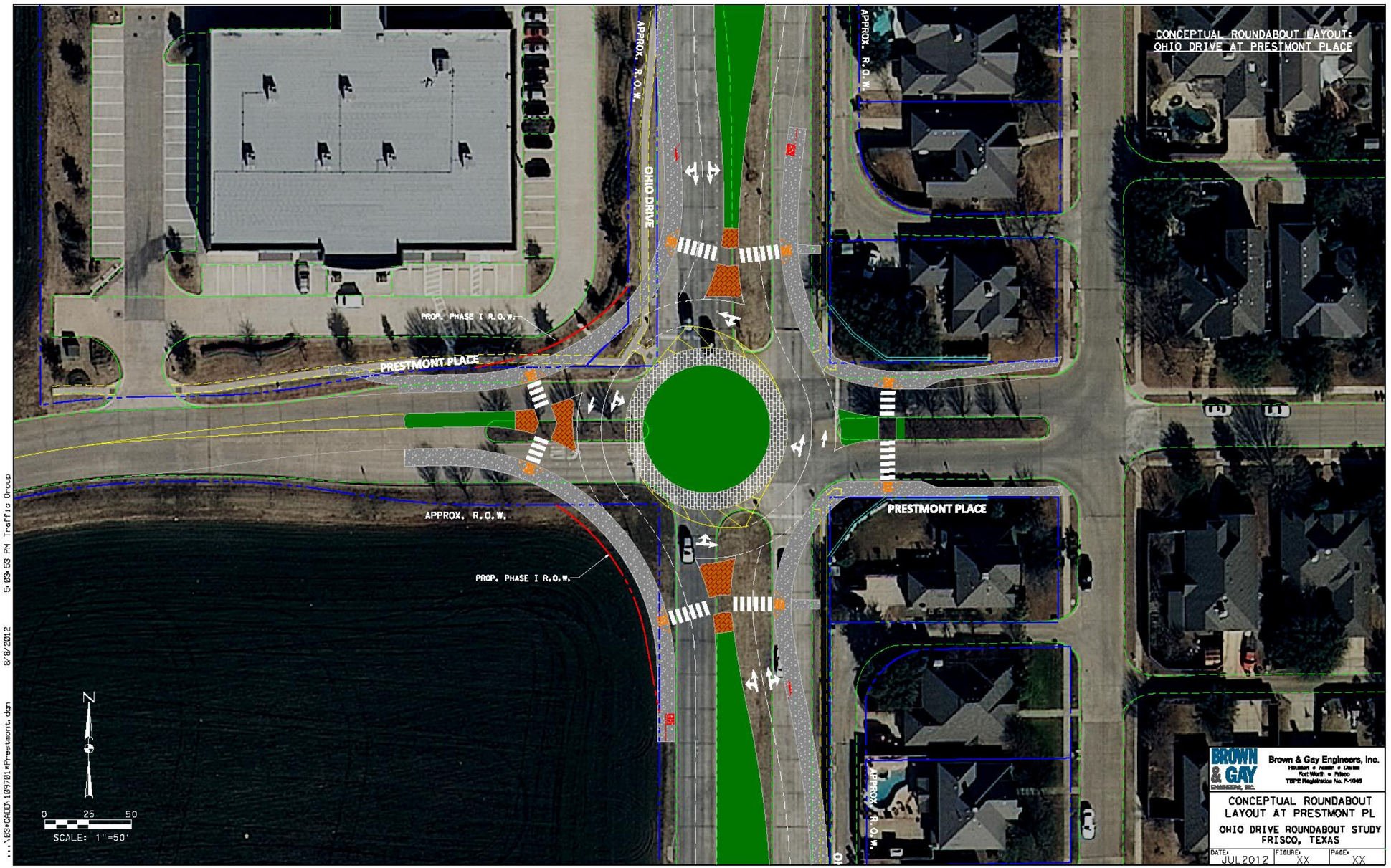


Figure 12 – Proposed Roundabout: Ohio Drive at Prestmont Place

4.5 Design Vehicle Paths

The proposed roundabout geometries were designed to accommodate a WB-50 truck. The striped 10-foot truck apron is designed to allow heavy vehicles to negotiate through the roundabout by providing additional traversable area around the central island. AutoTURN 8.0, a CAD-based vehicle turning path program, was used to determine the vehicle envelope and swept path. In addition, the truck turning dimensions for the City of Frisco's largest fire engines were coded into a custom fire truck within AutoTURN to test the concept designs. An exhibit showing the critical design vehicle turning paths within the proposed roundabouts are provided on **Figures 13, 14 and 15.** Although not all turning movements are shown in these exhibits, each intersection movement was tested at each roundabout.

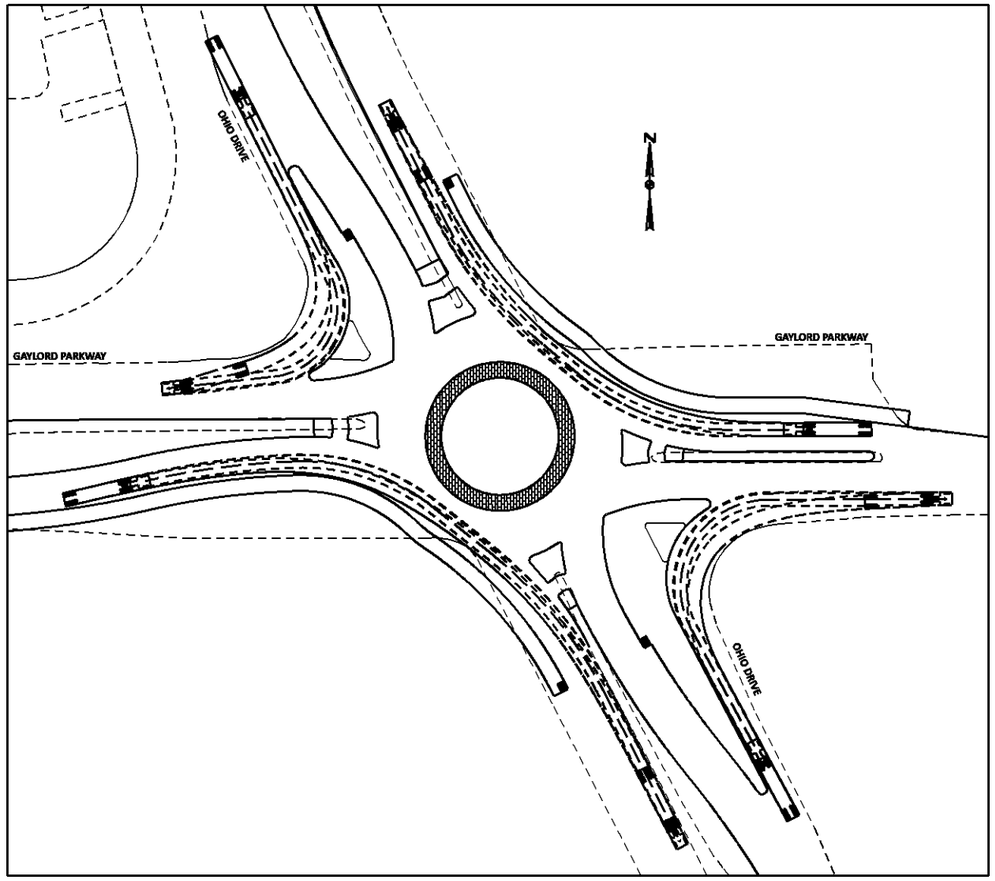


Figure 13 – Vehicle Paths: Ohio Drive at Gaylord Parkway – WB-50

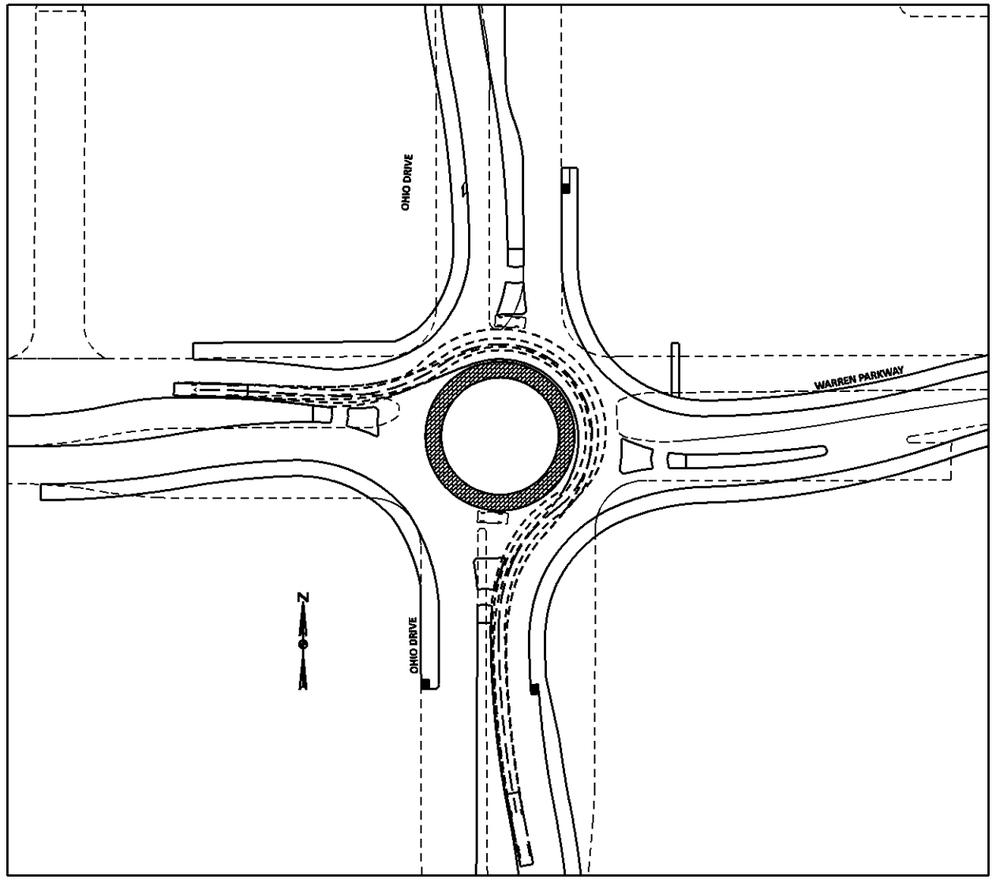


Figure 14 – Vehicle Paths: Ohio Drive at Warren Parkway – City of Frisco Fire Engine

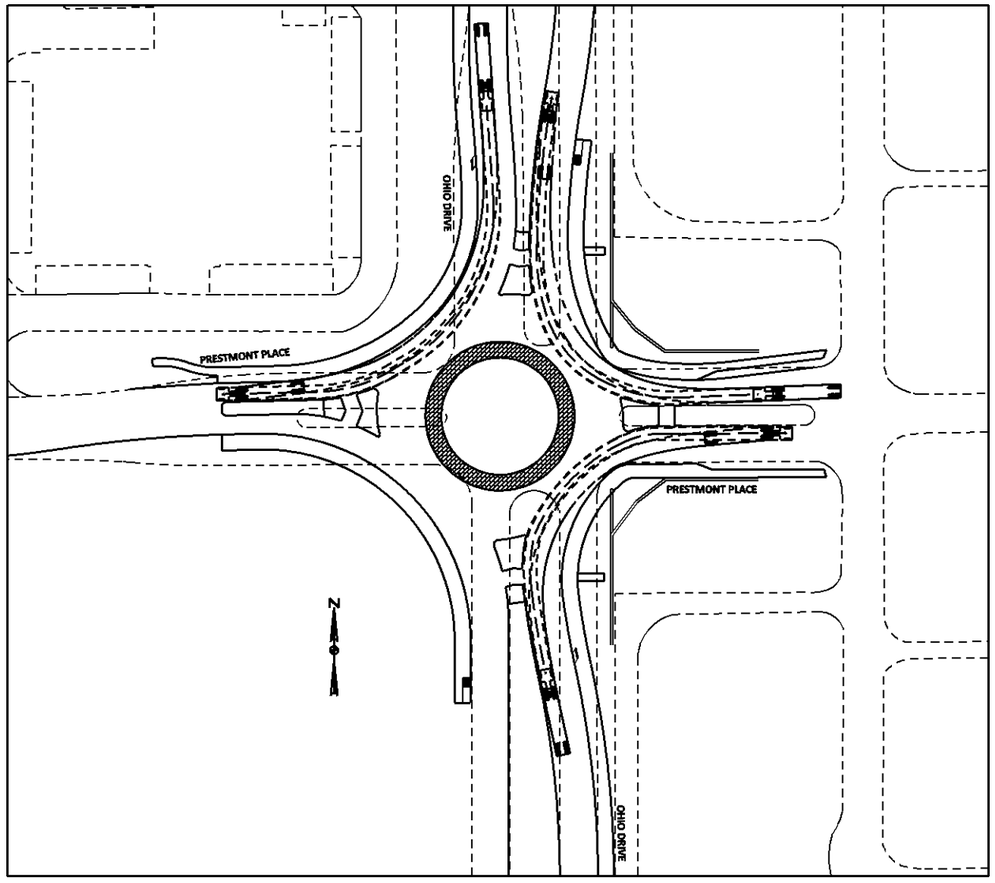


Figure 15 – Vehicle Paths: Ohio Drive at Prestmont Place – WB-50

4.6 Ohio Drive at Gaylord Parkway Ultimate Geometry

Gaylord Parkway is planned to be extended from Ohio Drive to Hillcrest Road by the year 2030. At this time, this project is not programmed in the City of Frisco's capital project list, but the roadway extension will be a four lane divided Boulevard section. When it occurs, the expanded pavement will easily tie into the proposed roundabout approach pavement. **Figure 16** shows how this connection would occur. In essence, the proposed roundabout's east approach geometry will be designed in such way that it will easily accommodate the connection to the four-lane Boulevard section with minimal reconstruction.

Also, **Figure 16** shows the proposed right turn by-pass lanes that may be needed in the future to increase the capacity of the proposed two-lane roundabout (labeled as Phase II). It is difficult to ascertain today if these by-pass lanes will be needed, but the City can proactively acquire additional right-of-way now before those parcels develop, or have the ROW dedicated as those parcels develop, in anticipation of the potential need in the future. The amount of Right-of-way needed is relatively small and is shown by the existing and proposed right-of-way lines on the figure.

4.7 Ohio Drive at Warren Parkway Ultimate Geometry

Similarly, the existing roadway section of Warren Parkway between Ohio Drive and Hillcrest Road will be reconstructed from a two-lane roadway to four-lane Boulevard by the year 2030. At this time, this project is not programmed in the City of Frisco's capital project list. When it occurs, the expanded pavement will easily tie into the proposed roundabout approach pavement. The proposed roundabout geometry will be designed in such way that it will easily accommodate the future roadway expansion with minimal reconstruction. **Figure 17** shows how the connection would occur.

Also, **Figure 17** shows the proposed right turn by-pass lanes that may be needed in the future to increase the capacity of the proposed two-lane roundabout (labeled as Phase II). Again, it is difficult to ascertain today if these by-pass lanes will be needed, but the City can proactively acquire additional right-of-way now before those parcels develop, or have the ROW dedicated when those parcels develop, in anticipation of the potential need in the future. The amount of Right-of-way needed is relatively small and is shown by the existing and proposed right-of-way lines on the figure.

4.8 Appearance

Aesthetics were considered as a benefit in the roundabout concept. The center island provides a large grassy area that the City of Frisco can use for low-height landscaping, creating a landmark for the surrounding area.

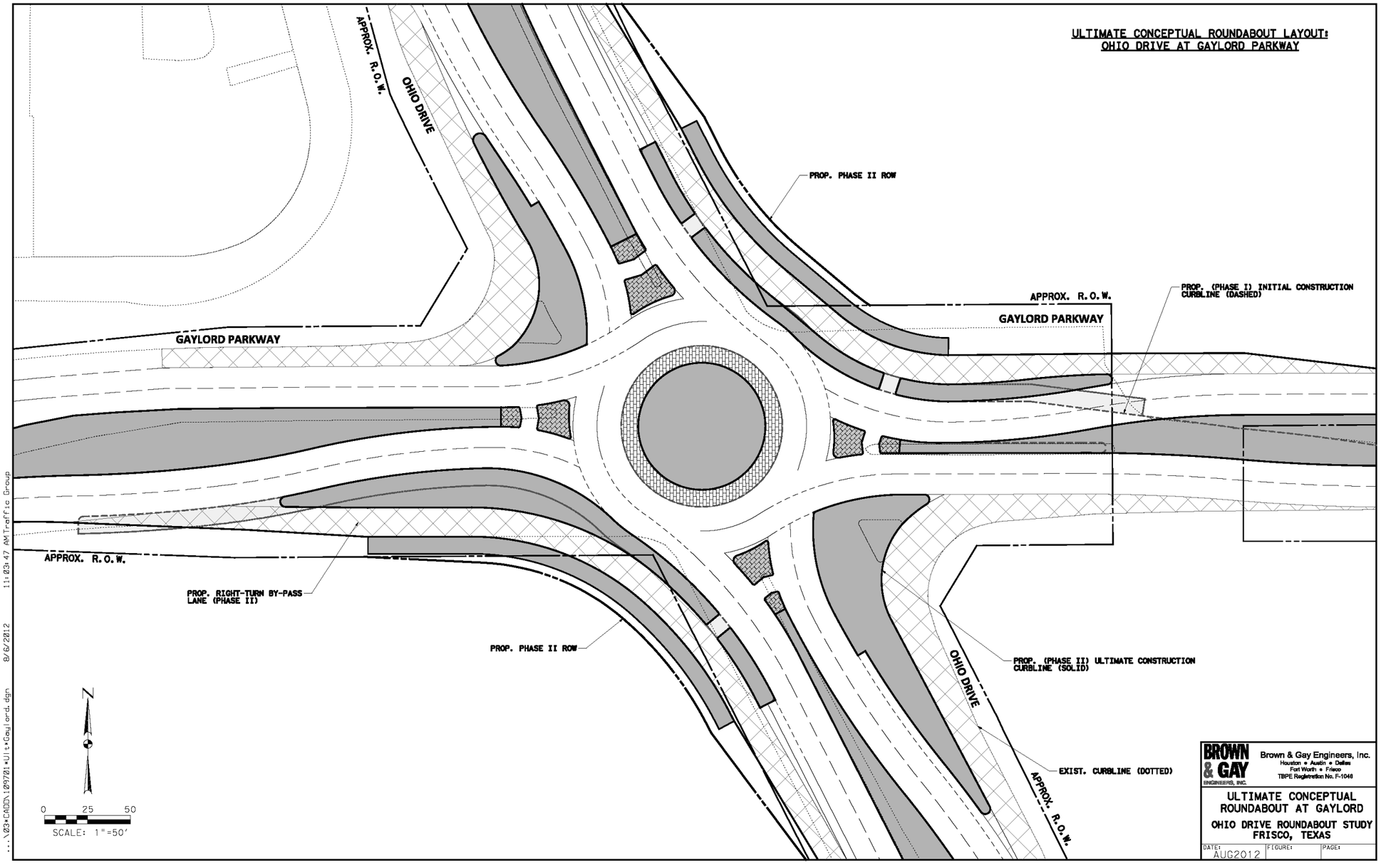


Figure 16 – Proposed Ultimate Roundabout: Ohio Drive at Gaylord Parkway

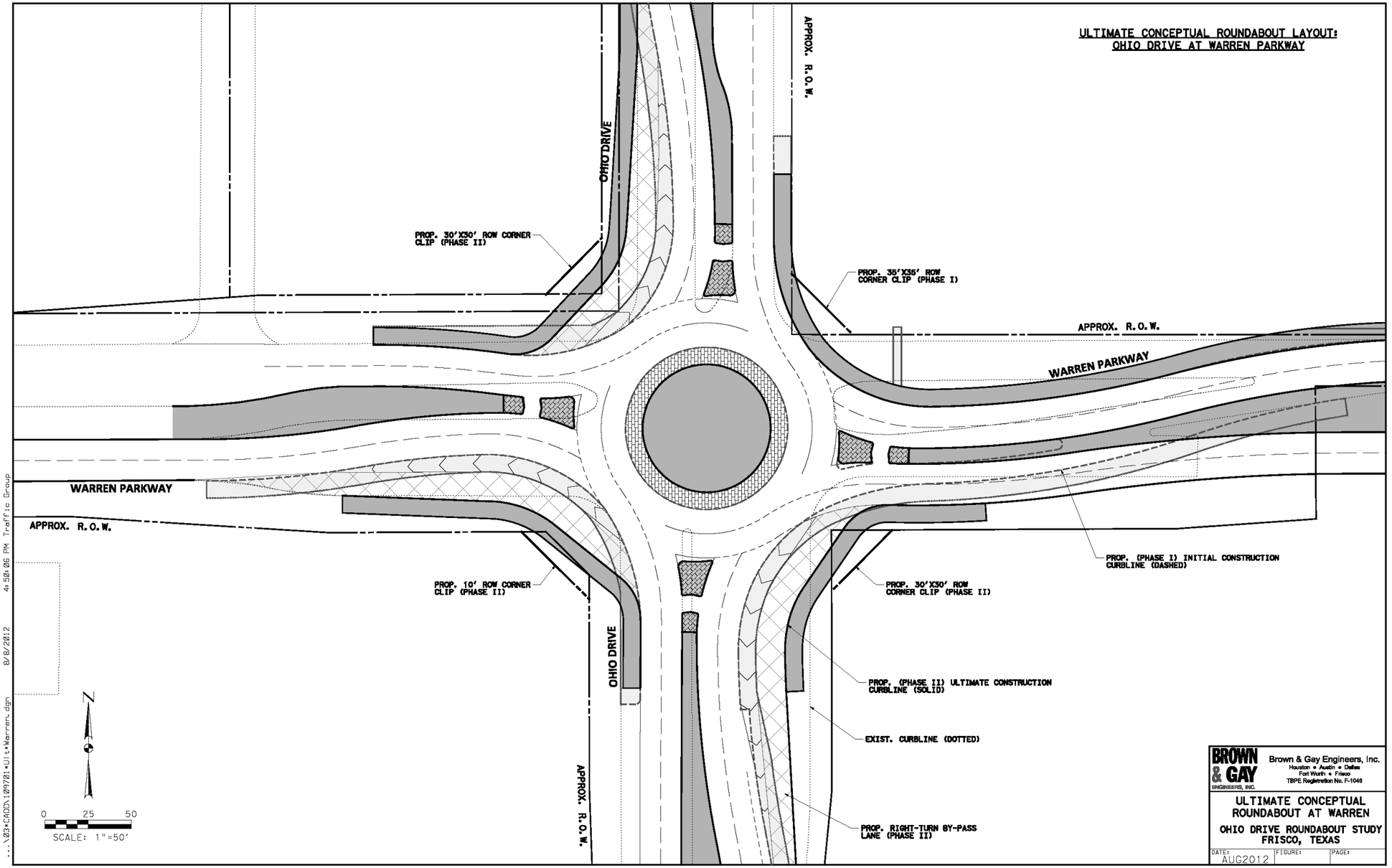


Figure 17 – Proposed Ultimate Roundabout: Ohio Drive at Warren Parkway

5.0 DRAINAGE AND UTILITIES

5.1 Drainage

The analysis Assumptions for the concept-level drainage evaluation for Ohio Drive at Gaylord Parkway and Ohio Drive at Warren Parkway are as follows:

- The existing pavement will be preserved as much as possible for the proposed roundabouts
- The drainage patterns will not be significantly altered by the roundabouts
- The impervious cover will be reduced by reducing pavement areas and increasing landscaped island areas, resulting in reduced run off into the existing drainage system
- Existing drainage inlets will be relocated as necessary, and new inlets will be added where potentially needed and connected to the existing storm sewer system
- The size of inlets and connecting pipes will be similar to the existing

For the Gaylord Parkway roundabout, the proposed storm sewer system will consist of roughly seven new inlets and 380 feet of pipe connections into two separate existing storm sewer systems that drain the intersection:

- One storm sewer system runs east-west under the west leg of Gaylord Parkway and flows west to connect with another existing system at Preston, which ultimately flows south to an outfall that is unknown at this time.
- The second storm sewer system flows north to Warren and eventually outfalls into an existing 8'x4' MBC structure.

For the Warren Parkway roundabout, the proposed storm sewer system will consist of approximately four new inlets and 60 feet of pipe connections into the existing storm sewer system that flows west and outfalls to an existing 8'x4' MBC structure.

The analysis Assumptions for the concept-level drainage evaluation for Ohio Drive at Prestmont Place are as follows:

- The roundabout will be built with new pavement and will be connected to the existing pavement on each approach to the intersection
- Drainage patterns will not be significantly altered except within the roundabout
- Impervious cover will remain practically unchanged
- Existing drainage inlets will be relocated as necessary, new inlets will be added where potentially needed and connected to the existing storm sewer system
- The size of inlets and connecting pipes will be similar to the existing

For the Prestmont Place roundabout, the proposed storm sewer system will consist of approximately four new inlets and 90 feet of pipe connections into the existing storm sewer system that flows south to Warren and then west, and outfalls to an existing 8'x4' MBC structure.

A topographical survey will be performed during the preliminary design phase to develop an accurate drainage and grading plan for each of the roundabouts.

5.2 Utilities

This section provides a summary of potential utility conflicts at each of the study intersections. The existing (above ground) utilities were identified in the field. Research regarding the locations of underground public and private utilities was conducted. Based on the available data provided by each utility entity and field reconnaissance, the following information was found:

5.2.1 Ohio Drive at Gaylord Parkway

Electric:
The depth of the underground Oncor Electric line that runs along the west side of Ohio Drive will need to be determined prior to the construction of several medians and sidewalks connected to the western leg of the intersection. There is a large above ground transformer box located at the southwest corner of the intersection. This box will not be affected under the proposed roundabout concept. However, the potential need for an eastbound right-turn by-pass lane in the future would require the relocation of this transformer.

Communications:
AT&T has underground telecommunication lines that run along the south side of Gaylord Parkway and along the west side of the northern leg of the intersection. Construction of various medians, sidewalks, and full depth pavement near the southwest corner may affect these communication lines, depending on how deep they are.

Gas:
There are no gas conflicts identified at this intersection.

Water:
The depth of the water lines that run along the north side of Gaylord Parkway and the west side of Ohio Drive will need to be determined. The water line that turns near the northeast corner of the intersection may possibly be affected by the full depth pavement construction. There are no relocations of fire hydrants needed at this intersection. However, existing water valves may require adjustment.

Sanitary Sewer:
There is a sanitary sewer line that generally runs along the west side of the center median on Ohio Drive. This sanitary line runs through the proposed roundabout's center island. Therefore, the depth of this line should be considered when removing full depth concrete pavement within the center island. Existing manhole covers may require adjustment.

Signal:
Currently, this intersection is equipped with traffic signal pull boxes and conduit that extend to each corner. Although this equipment will not be used under the proposed roundabout concepts, every effort shall be taken to preserve the conduit and pull boxes already in place.

5.2.2 Ohio Drive at Warren Parkway

Electric:
The depth of the underground Oncor Electric line that runs along the west side of Ohio Drive will need to be determined prior to the construction of sidewalks at the northwest and southwest corners.

The overhead power lines along the north side of Warren Parkway will not be affected by the proposed roundabout concept.

Communications:
AT&T has underground telecommunication lines that run along the south side of Warren Parkway and along the west side of the southern leg of the intersection. Construction of various medians, sidewalks, and full depth pavement near the southeast corner may affect these communication lines. There is an existing telephone pedestal at the southeast corner that may require relocation.

There is a Grande Communication's line that runs along the north side of Warren Parkway and turns north, along the west side of Ohio Drive. There appears to be no conflict with this line.

Gas:
There is a Coserv gas line that runs south of the western intersection leg. However, there are no gas conflicts identified at this intersection.

Water:
The depth of the water lines that run along the north side of Warren Parkway and the west side of Ohio Drive will need to be determined. There are no relocations of fire hydrants needed at this intersection. However, existing water valves on the northwest corner will require adjustment to proposed sidewalk levels.

Sanitary Sewer:
There is a sanitary sewer line that runs along the west side of Ohio Drive and turns to the west, along the south side of Warren Parkway. The depth of this line will need to be determined to avoid conflicts with the construction of the southwest corner sidewalk. An existing manhole cover will require adjustment to proposed sidewalk levels.

Signal:
Currently, this intersection is equipped with traffic signal pull boxes and conduit that extend to southwest and southeast corners. Although this equipment will not be used under the proposed roundabout concepts, every effort shall be taken to preserve the conduit and pull boxes already in place.

5.2.3 Ohio Drive at Prestmont Place

Electric:
There is an underground Oncor Electric line that runs along the north side of Prestmont Place that veers to the north. The areas of full depth pavement construction at the northwest corner and along the center of the northern intersection leg may affect this line. One street light in the median of the west side of Prestmont Place will have to be removed or relocated.

Communications:
AT&T has underground telecommunication lines that run along the north side of Prestmont Place and along the west side of Ohio Drive. Construction of various medians, sidewalks, and full depth pavement near the northwest and southwest corners may affect these communication lines depending on how deep they are. A ground box on the southwest corner will need to be relocated.

Gas:
There is an Atmos gas line that runs along the south side of Prestmont Place and west of the southern intersection leg. A large area of full depth pavement construction at the southwest corner may affect this line.

Water:
The depth of the water lines that run along the north side of Warren Parkway and the east side of Ohio Drive will need to be determined. A large area of full depth pavement construction at the northwest corner may affect this water line. The fire hydrant located at the northwest corner (nearest to the intersection) will need to be relocated. Existing water valves at this intersection will require adjustment.

Sanitary Sewer:
There appears to be no sanitary sewer lines that are in conflict with the proposed roundabout concepts at this intersection. However, existing manhole covers may require adjustment.

Signal:
This intersection does not have any traffic signal equipment at this time.

In addition, one tree on the northwest corner and four trees in the median of the west approach will have to be removed and if possible, relocated per city guidelines.

6.0 RIGHT OF WAY

Right of Way (ROW) information was obtained from the following sources:

- NCTCOG geographic information system (GIS) shape files of various layers were used to develop the working base files for this project. The data included layers for pavement edges, parcel boundaries, city utility lines, and an aerial photograph background.

- The City of Frisco provided available as-built drawings of various roadway projects within the study area. The as-built plans included the project for the completion of Ohio Drive. Information regarding grading and right-of-way along Ohio Drive were found applicable for this study.

The information above in many instances is in conflict with each other, and assumptions had to be made in order to locate the approximate ROW lines in relation to the roadways. Therefore, the ROW lines shown on the concept plans are approximate. A full survey and ROW line research will be necessary to accurately depict the existing conditions.

The proposed roundabouts were designed to fit mostly within the existing ROW, except with some corners where ROW corner clips will be needed. There are no physical obstructions at those corners that interfere with the proposed roundabout geometry.

Below is a summary of the existing ROW conditions for each of the study intersections. Generally, each intersection approach was widened to accommodate additional turn lanes.

- Ohio Drive at Gaylord Parkway: The ROW along Ohio drive is generally 120 feet and widens to approximately 140 feet at the intersection. The ROW along Gaylord Parkway is approximately 70 feet and 120 feet to the east and west of Ohio Drive, respectively. Similarly, the ROW along Gaylord Parkway widens to approximately 140 feet at the intersection.

- Ohio Drive at Warren Parkway: The ROW along Ohio drive is generally 100 feet to the north and 120 feet to south of Warren Parkway. The ROW widens to approximately 140 feet on the northbound approach and approximately 110 feet on the southbound approach to the intersection. The ROW along the eastbound approach is approximately 120 feet and widens to about 140 at the intersection. The ROW along the westbound approach is approximately 30 feet and widens to about 115 feet at the intersection.

- Ohio Drive at Prestmont Place: The ROW along Ohio drive is generally 100 feet to the north and south of Prestmont Place. However, the ROW widens to approximately 120 feet on the southbound approach to the intersection. The ROW along the eastbound approach is approximately 50 feet and widens to about 80 at the intersection. The ROW along the westbound approach is approximately 80 feet.

7.0 TRAFFIC CONTROL PLAN FOR CONSTRUCTION

It is anticipated that the proposed roundabouts at Gaylord Parkway and Warren Parkway can be built while maintaining one lane of traffic open in each direction. On the other hand, the proposed roundabout at Prestmont Place may require a temporary closure of the intersection. A conceptual plan for traffic control during construction is provided below for each intersection.

7.1 Ohio Drive at Gaylord Parkway

This proposed roundabout will utilize the existing concrete pavement and only minimal amounts of new pavement will be constructed. It will be possible to maintain the intersection open to traffic while the roundabout construction is ongoing. The basic construction sequence is as follows:

Phase I

1. Close the east leg of Gaylord Parkway temporarily. Currently, this leg only carries approximately 540 vehicles per day and is back access to the Chevrolet dealership. It is estimated that the east leg of Gaylord Parkway would be closed for two months.
2. Maintain one lane of traffic open in each direction on the west side of Ohio Drive (on the existing southbound lanes pavement), and one lane of traffic open in each direction on the north side of Gaylord Parkway, as illustrated in **Figure 18**.
3. Build the east half of the proposed roundabout, except for the center island and truck apron.

Phase II

1. Move traffic to the completed lanes on the east side of Ohio Drive and the north side of Gaylord Parkway, as illustrated in **Figure 19**.
2. Build the remaining approaches and islands on the west side of Ohio Drive and the south side of Gaylord Parkway, except for the center island and truck apron.

Phase III

1. Open the roundabout to traffic but as a single lane roundabout, with one lane open in each direction, as illustrated in **Figure 20**.
2. Construct the center island and truck apron.
3. If the asphalt overlay option is selected, place the final pavement overlay.
4. Install final signing and pavement markings.

7.2 Ohio Drive at Warren Parkway

This proposed roundabout will utilize the existing concrete pavement and only minimal amounts of new pavement will be constructed. It will be possible to maintain the intersection open to traffic while the roundabout construction is ongoing. The basic construction sequence is the same as the construction sequence for the roundabout at Gaylord Parkway as explained in Section 7.1. Therefore, the east leg of Warren Parkway will also be closed temporarily. Access to and from properties along Warren Parkway (east of Ohio Drive) will be maintained by detour routes via Hillcrest Road, Lebanon Road, or Prestmont Place.

7.3 Ohio Drive at Prestmont Place

Due to the proposed geometry of the roundabout which is shifted to the west, it will be desirable to construct new pavement for this roundabout. Maintaining two-way traffic during construction would be very difficult and expensive, since it would require the construction of temporary pavements. Therefore, two other alternatives were considered as follows:

Alternative 1 - Close the intersection for construction during a summer month and accelerate construction to take the minimum possible time. It is estimated that the roundabout can be built in approximately one month in this situation. Detour signing would have to be provided for both pass-through traffic and local traffic. For pass-through traffic, detour signing would be placed on the adjacent major thoroughfares to re-route through-traffic around the intersection. For local traffic, local detour signing would re-route traffic to the adjacent streets.

Alternative 2 - Reduce the number of lanes to a single lane in only one direction, to maintain one-way traffic. This would allow constructing the roundabout in two halves. Detour local traffic in the other direction, and detour pass-through traffic around the intersection. While this alternative would maintain some traffic through the intersection, it would take longer for the roundabout construction. It would also cost more and require extensive traffic control during construction.

Alternative 1 would be the more desirable choice since there are other existing streets that can be used as alternate routes to access the properties in the vicinity of the intersection.

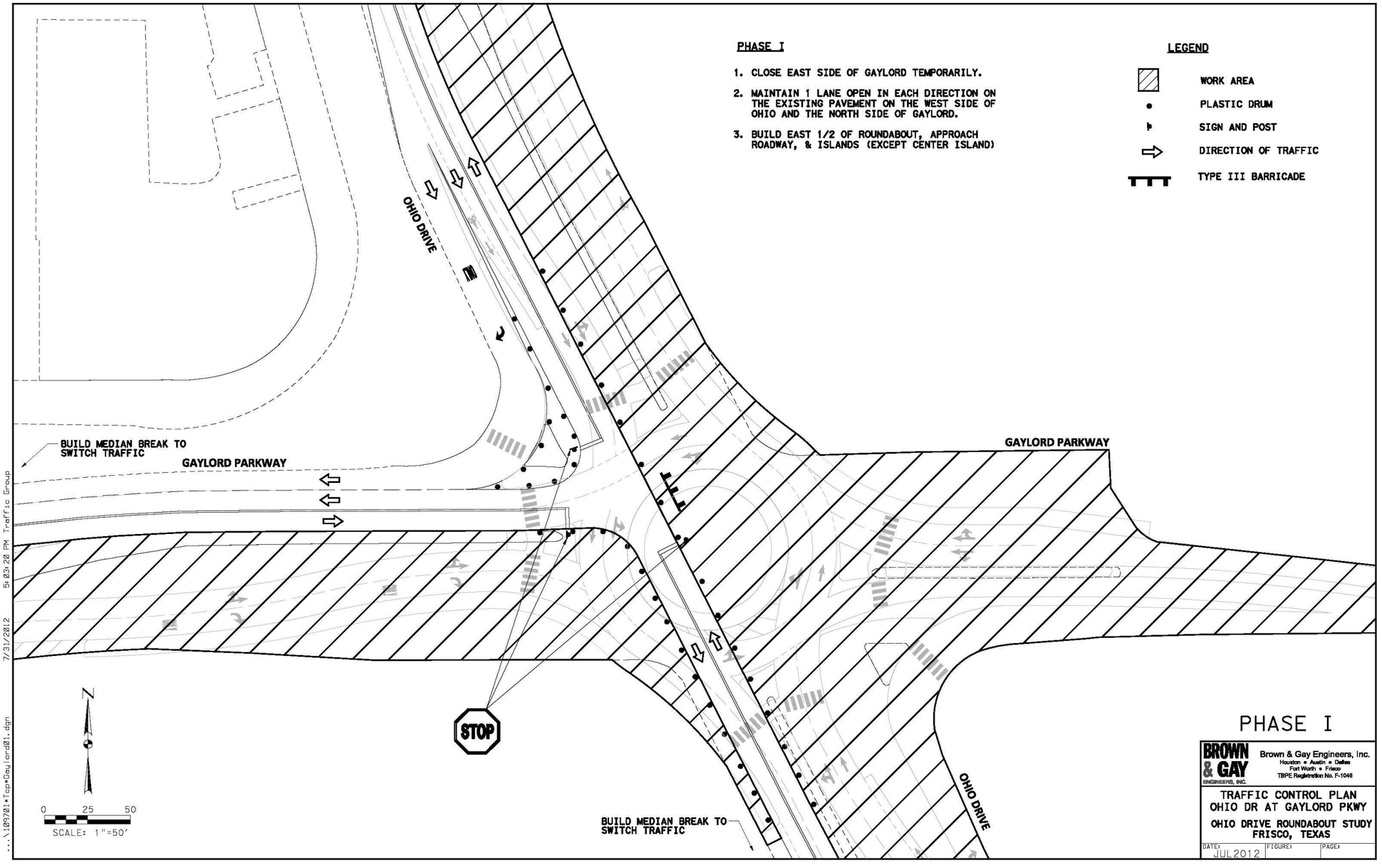


Figure 18 – Traffic Control Plan Phase I: Ohio Drive at Gaylord Parkway

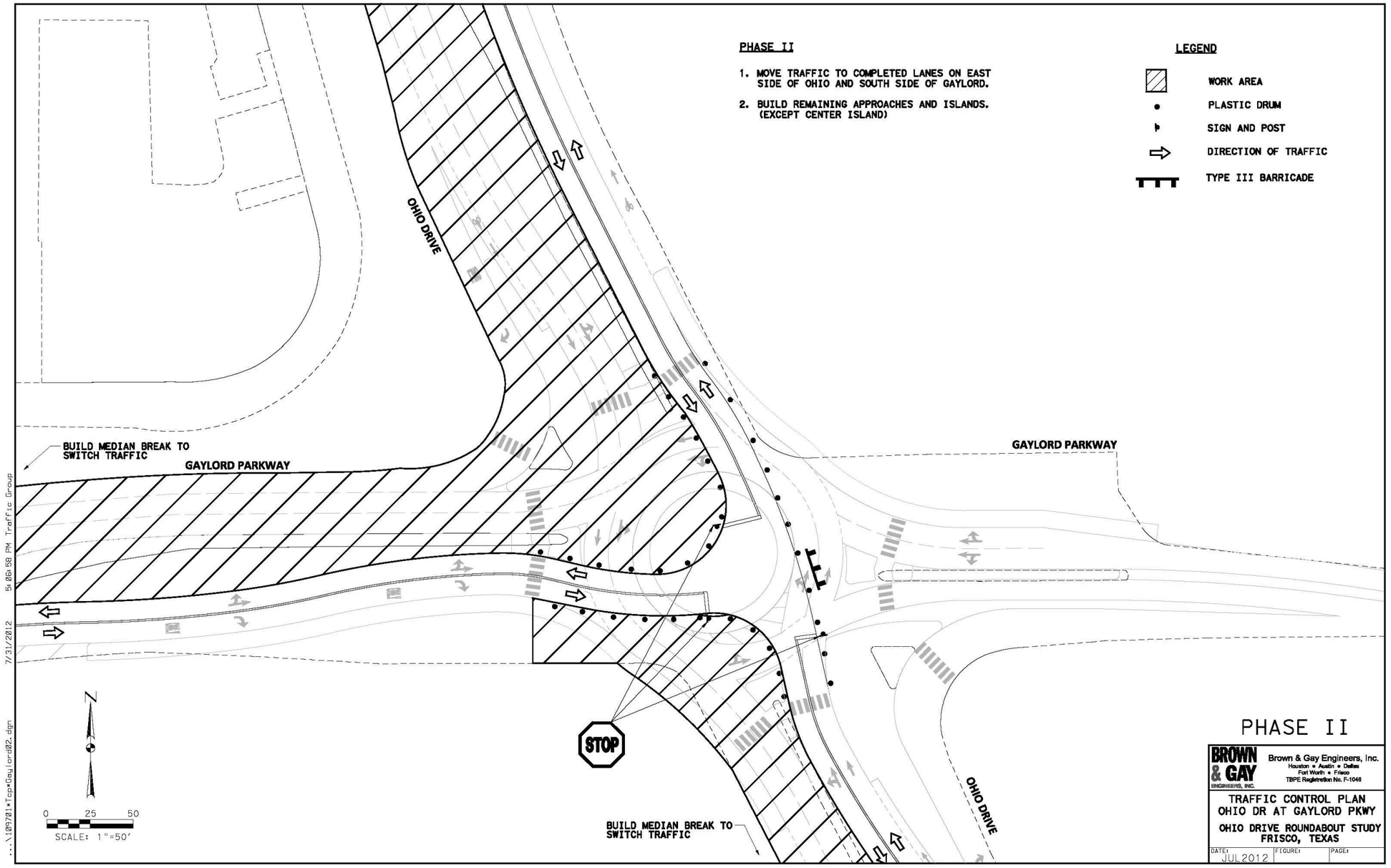


Figure 19 – Traffic Control Plan Phase II: Ohio Drive at Gaylord Parkway

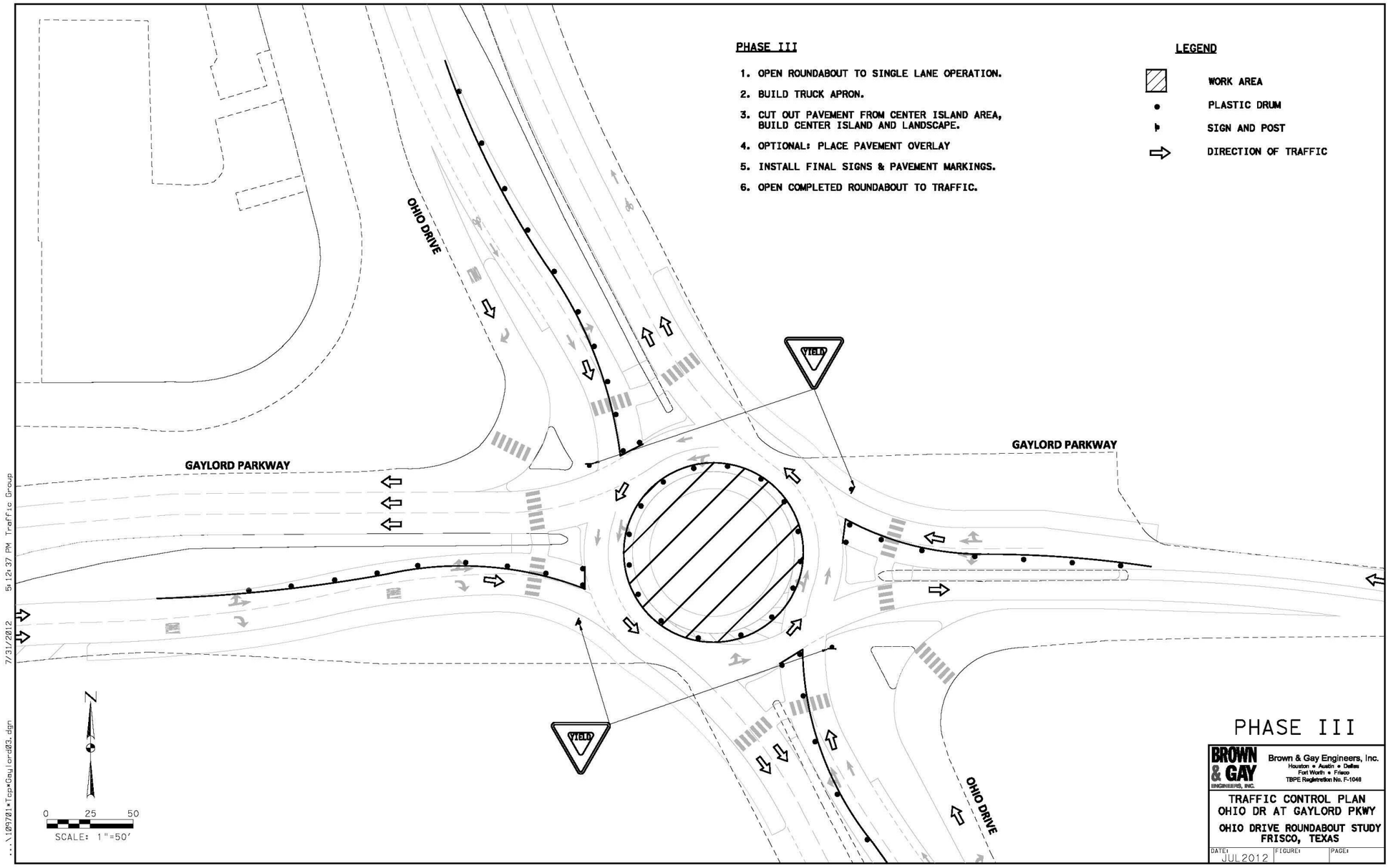


Figure 20 – Traffic Control Plan Phase III: Ohio Drive at Gaylord Parkway

8.0 CONSTRUCTION COST

Concept level quantity estimates were performed in order to prepare a concept level Engineer's Opinion of Probable Construction Cost (OPCC). The items quantified included only major items of work, related to pavement demolition and reconstruction, traffic island construction, major drainage items, signing and illumination. Other items such as pavement markings were included as a percent of the OPCC of the major items. The OPCC includes the following major items and assumptions:

- Removal of portions of the existing concrete pavement and curb
- Construction of 8" concrete pavement as needed by the proposed roundabout geometry, with an alternative to 6" cement stabilized base
- Construction of a truck apron with special finished surface (textured and colored finish)
- Construction of splitter islands and other traffic islands with 6" concrete curb doweled into existing concrete pavements and brick paver surfaces or similar, and grass.
- Concrete splitter islands and concrete curb for the center island
- Major drainage items such as new drainage inlets and pipe connections into the existing storm drainage system
- Signing and pavement markings
- Intersection safety lighting
- Signs, barricades and temporary pavement markings for traffic control during construction

The clean removal of existing pavement markings from the existing concrete pavement will be a challenge. A method that accomplishes the removal without leaving unsightly marks will need to be determined, so that the new roundabout pavement markings are clearly visible. The use of contrast pavement markings for the proposed striping should be considered. In the small chance that the existing pavement markings could not be satisfactorily removed, then an option would be to apply a 1 ½" asphalt overlay of the drainable/Permeable type, similar to that used by TxDOT. The cost is not included in the estimate since this a last resort option.

Separate OPCCs were prepared for each of the three proposed roundabouts, and they are shown in **Tables 7, 8 and 9**.

Table 7 - Opinion of Probable Construction Cost
Ohio Drive at Gaylord Parkway

ITEM NO	DESCRIPTION	UNIT	QUANT	UNIT COST	TOTAL COST
	REMOVE CONC PVMT AND CURB	SY	3,190	$ 5.00	$ 16,000.00
	CONC CURB (DOWEL)	LF	3,785	$ 10.00	$ 37,900.00
	CONC SIDEWALKS (4")	SF	8,230	$ 4.00	$ 32,900.00
	CONC DIRECTIONAL ISLAND	SY	920	$ 30.00	$ 27,600.00
	WHEELCHAIR RAMPS	EA	14	$ 1,000.00	$ 14,000.00
	DECORATIVE PAVERS	SY	280	$ 20.00	$ 5,600.00
	CONC PVMT (8")	SY	70	$ 50.00	$ 3,500.00
	STABILIZED BASE (6")	SY	70	$ 10.00	$ 700.00
	TRUCK APRON	SY	290	$ 50.00	$ 14,500.00
	SELECT FILL AND GRASS SEEDING	SY	2,990	$ 2.00	$ 5,980.00
	DRAINAGE INLET	EA	7	$ 2,500.00	$ 17,500.00
	CONVERT INLET TO MANHOLE	EA	4	$ 2,000.00	$ 8,000.00
	RCP- 24"	LF	380	$ 60.00	$ 22,800.00
	TRENCH EXCAVATION	LF	380	$ 20.00	$ 7,600.00
	TRAFFIC SIGNS	EA	32	$ 250.00	$ 8,000.00
	BARRICADES, SIGNS, TRAFFIC HANDLING	MO	3	$ 5,000.00	$ 15,000.00
	PAVEMENT MARKING REMOVAL	LS	1	$ 5,000.00	$ 5,000.00
	PAVEMENT MARKING INSTALLATION	LS	1	$ 15,000.00	$ 15,000.00
	INTERSECTION SAFETY LIGHTING	LS	1	$ 10,000.00	$ 10,000.00
				$ -	$ -
				$ -	$ -
				$ -	$ -
				SUB-TOTAL	$ 267,580.00
				CONTINGENCIES (20%)	$ 53,500.00
				TOTAL	$ 321,100.00

This preliminary cost estimate does not include the cost of potential utility relocations or additional right of way acquisition.

Table 8 - Opinion of Probable Construction Cost
Ohio Drive at Warren Parkway

ITEM NO	DESCRIPTION	UNIT	QUANT	UNIT COST	TOTAL COST
	REMOVE CONC PVMT AND CURB	SY	3,540	$ 5.00	$ 17,700.00
	CONC CURB (DOWEL)	LF	3,530	$ 10.00	$ 35,300.00
	CONC SIDEWALKS (4")	SF	2,160	$ 4.00	$ 8,600.00
	CONC DIRECTIONAL ISLAND	SY	0	$ 30.00	$ -
	WHEELCHAIR RAMPS	EA	12	$ 1,000.00	$ 12,000.00
	DECORATIVE PAVERS	SY	180	$ 20.00	$ 3,600.00
	CONC PVMT (8")	SY	1,390	$ 50.00	$ 69,500.00
	STABILIZED BASE (6")	SY	1,390	$ 10.00	$ 13,900.00
	TRUCK APRON	SY	290	$ 50.00	$ 14,500.00
	SELECT FILL AND GRASS SEEDING	SY	1,490	$ 2.00	$ 2,980.00
	DRAINAGE INLET	EA	4	$ 2,500.00	$ 10,000.00
	CONVERT INLET TO MANHOLE	EA	2	$ 2,000.00	$ 4,000.00
	RCP- 24"	LF	60	$ 60.00	$ 3,600.00
	TRENCH EXCAVATION	LF	60	$ 20.00	$ 1,200.00
	TRAFFIC SIGNS	EA	32	$ 250.00	$ 8,000.00
	BARRICADES, SIGNS, TRAFFIC HANDLING	MO	3	$ 5,000.00	$ 15,000.00
	PAVEMENT MARKING REMOVAL	LS	1	$ 5,000.00	$ 5,000.00
	PAVEMENT MARKING INSTALLATION	LS	1	$ 15,000.00	$ 15,000.00
	INTERSECTION SAFETY LIGHTING	LS	1	$ 10,000.00	$ 10,000.00
				$ -	$ -
				$ -	$ -
				$ -	$ -
				SUB-TOTAL	$ 249,880.00
				CONTINGENCIES (20%)	$ 50,000.00
				TOTAL	$ 299,900.00

This preliminary cost estimate does not include the cost of potential utility relocations or additional right of way acquisition.

Table 9 - Opinion of Probable Construction Cost
Ohio Drive at Prestmont Place

ITEM NO	DESCRIPTION	UNIT	QUANT	UNIT COST	TOTAL COST
	REMOVE CONC PVMT AND CURB	SY	5,830	$ 5.00	$ 29,200.00
	CONC CURB (DOWEL)	LF	2,670	$ 10.00	$ 26,700.00
	CONC SIDEWALKS (4")	SF	1,390	$ 4.00	$ 5,600.00
	CONC DIRECTIONAL ISLAND	SY	40	$ 30.00	$ 1,200.00
	WHEELCHAIR RAMPS	EA	12	$ 1,000.00	$ 12,000.00
	DECORATIVE PAVERS	SY	100	$ 20.00	$ 2,000.00
	CONC PVMT (8")	SY	3,710	$ 50.00	$ 185,500.00
	STABILIZED BASE (6")	SY	3,710	$ 10.00	$ 37,100.00
	TRUCK APRON	SY	290	$ 50.00	$ 14,500.00
	SELECT FILL AND GRASS SEEDING	SY	770	$ 2.00	$ 1,540.00
	DRAINAGE INLET	EA	4	$ 2,500.00	$ 10,000.00
	CONVERT INLET TO MANHOLE	EA	2	$ 2,000.00	$ 4,000.00
	RCP- 24"	LF	90	$ 60.00	$ 5,400.00
	TRENCH EXCAVATION	LF	90	$ 20.00	$ 1,800.00
	TRAFFIC SIGNS	EA	32	$ 250.00	$ 8,000.00
	BARRICADES, SIGNS, TRAFFIC HANDLING	MO	3	$ 5,000.00	$ 15,000.00
	PAVEMENT MARKING REMOVAL	LS	1	$ 5,000.00	$ 5,000.00
	PAVEMENT MARKING INSTALLATION	LS	1	$ 15,000.00	$ 15,000.00
	INTERSECTION SAFETY LIGHTING	LS	1	$ 10,000.00	$ 10,000.00
				$ -	$ -
				$ -	$ -
				$ -	$ -
				SUB-TOTAL	$ 389,540.00
				CONTINGENCIES (20%)	$ 77,900.00
				TOTAL	$ 467,400.00

This preliminary cost estimate does not include the cost of potential utility relocations or additional right of way acquisition.

9.0 CONCLUSIONS

Based on the foregoing analysis, the following conclusions can be made:

- The proposed roundabouts will provide:
  - Excellent level of service under existing traffic volume loadings
  - Acceptable level of service through year 2030 during peak hours
  - A minimal amount of vehicular delay during off-peak hours
  - A reduction in the severity of vehicular crashes due to slower speeds and minimal conflicts.
  - High level of safety for pedestrians and bicyclists
  - A safer and more efficient alternative to a standard signal
  - Lower maintenance cost as the maintenance cost of a modern roundabout is significantly less than the maintenance cost of a signalized intersection
- The proposed roundabout at Gaylord Parkway can be built utilizing most of the existing pavement and drainage system. It can be built within the existing right-of-way, although small easements will be needed on the northeast and southwest corners to accommodate sidewalks.
- The proposed roundabout at Warren Parkway can be built utilizing most of the existing pavement and drainage system. It can be built within the existing right-of-way, although a small easement will be needed on the northeast corner to accommodate a sidewalk.
- The roundabouts at Gaylord and Warren may have to be expanded in the future to include right turn by-pass lanes to accommodate projected peak hour flows for the year 2030. This expansion will require additional ROW at some corners, totaling approximately 11,200 square feet.
- These relatively small amounts of right-of-way can be obtained by the City through the dedication process, as those currently undeveloped corner properties go into development mode.
- The roundabout at Prestmont Place will require approximately 3,300 square feet of right-of-way from the northwest and southwest corners to accommodate the proposed roundabout geometry. No right-of-way will be needed on the northeast and southeast corners. There will be a significant amount of additional pavement required at this intersection compared to the other roundabouts. Therefore, construction cost for the roundabout at Prestmont Place is higher than the other two roundabouts.

APPENDIX

A. HCM Capacity Worksheets